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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/533,014
Filing Date: April 28, 2005
Appellant(s): BOSSELMANN ET AL.

John P. Musone
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 11/24/08 appealing from the Office action mailed 7/9/08.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 4804905 | Ding | 2-1989 |
| 5514482 | Strangman | 5-1996 |
| 5552711 | Deegan | 9-1996 |

IEEE Interharmonic Task Force, "Interharmonics in Power Systems", 12/1/97, pp. 1-9

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 21-25, 27-36 and 41 are rejected under 35 U.S.C. 103(a) as being obvious over Ding (4,804,905) in view of Strangman (5,514,482) and Deegan (5,552,711).

Regarding claims 21-23, 30, 32, 33 and 41, Ding teaches a rotor blade measuring element for electric charge distribution (Fig. 3-5 and col. 4, line 5-15) arranged near the row of rotor blades (col. 3, line 5-30) made of an electrically conductive material (6, Fig. 5) with an electrically connection to a reference potential for the blades (6, Fig. 5) and teaches an operating frequency range that is at least in the kilohertz band (50 kHz, col. 2, line 26) as in claims 21, 23, 32, 41. Ding further teaches

the deviation from a threshold responsive to a location of the rotor blades arranged on a rotor shaft (s/h, Fig. 1a), relative to the outlet of the engine (1, Fig. 9 and col. 5, line 40) as in claims 21, 32 and relative to outlet load condition of the engine (col. 7, line 45-55) as in claim 41. Ding includes a description of the radial disposition of a measuring element (1, Fig. 2 and col. 5, line 45-50) as in claims 21, 32, 41. Ding further teaches a steady state or transient measurement (col. 5, line 14-35) for the deviation from a threshold. In light of the specification, the "amplitude height" in the time domain or the frequency domain (instant disclosure, p. 3, par. 9) is admitted to be the preferred measure of quality of the electric field generated by the blade or vane charges and the definable threshold, which is the same teaching of Ding (col. 4, line 64-68 and col. 5, line 8-11), as in claims 21, 22, 23, 32, 41. Ding also correlates the variation of the magnitude of the signal according to the amplitude height or magnitude of the other blades (col. 5, line 37-40) or guide vanes (col. 8, line 36 and Fig. 1a) thus performing the same function and intended use as in claims 22 and 33. For a threshold responsive to a location of the rotor blades or the guide vanes relative to an outlet of the turbo engine, as in claims 21 and 32, Ding teaches a monitoring unit using signals from the pressure, temperature and speed measurements outlet load condition of the engine (col. 7, line 45-55) to compare to a deviation from a threshold location, comparing the signal from one blade to the signals from other blades, which determines the deviation from a defined threshold (col. 8, line 56-65). Ding further teaches that the capacitive measurement of the rotor clearance is directly related to a wear condition (col. 8, line 50-60) and converts the charge measured into a voltage signal (col. 4, line 64-67) which

his computer converts to millimeter gap values (col. 5, line 10). Ding also uses an electrically insulating surface on the inside of the casing wall and sensor as an alternative to coating the blade surface (Teflon insulation, col. 6, line 45-50 and coating, col. 6, line 60-65).

Ding does not teach rotor blades having an electrically insulating surface coating and Ding does not explicitly teach the strength of the electric field or magnetic field as an indication of a level of wear or defect that can arise in the electrically insulating surface.

Strangman teaches a plurality of turbine rotor blades and vanes (22, 24, Fig. 3, abstract and col. 5, line 67) made of an electrically conducting material (metal, col. 2, lines 5-10) having an electrically insulating coating surface (ceramic zirconia, col. 6, lines 1-30) as in claim 30, arranged on a rotor shaft (20, Fig. 3) that is rotatably mounted in a housing. It is well known to one of ordinary skill that good thermal insulators, such as zirconia, will also have good electrical insulative properties, since they are similar effects, which is confirmed by any standard handbook for electrical engineers.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included Strangman's plurality of metal rotor blades that are electrically insulated in Ding's turbo engine measuring and monitoring system, for the benefit of increased charge retention for a maximized sensor performance as well as improved thermal insulating effects that provide higher strength and increased temperature range, as suggested by Strangman (col. 8, line 11-20 and col. 6, line 10-20).

Ding as modified by Strangman (D-S) does not explicitly teach the strength of the electric or magnetic field as an indication of a level of wear or defect that can arise in the electrically insulating surface.

Deegan, from the same field of endeavor, teaches that the electric strength of ions (electric field measurement) changes with wear or defect, such as small flaws, intergranular cracking, or even crystalline erosion (col. 2, line 30-40 and line 53-57) on a rotor blade surface, that contribute to development of hot spots, all of which could reasonably occur to an electrically insulating surface, to one of ordinary skill. Deegan further teaches spectrum analysis (col. 3, line 19) of the electromagnetic signal and filtering in the kilohertz frequency range (col. 2, line 40) as well. Deegan also teaches measuring the strength (level detection, col. 3, line 20) of the electric field antenna as an indication of defect or wear and that the exposure of metallic ions in a hot spot of rotor blade wear and defect causes a level change that is measurable with a simple antenna and radio receiver (col. 1, line 50-55), which is related to a failure of insulation (worn blade tip, col, 1, line 44) as well as the number of ions created at the hot spot (col. 1, line 46 and col. 2, line 44), as in claims 21, 32, 41, in light of the specification (ionized particles, instant disclosure, par. 43). Deegan further teaches that he is also measuring charge level since the frequency emission is a function of the ratio of charge to mass of the ions (col. 1, line 50-55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used Deegan's monitoring of electric field strength converted to frequency as an indication of wear or defect that can arise in the

electrically insulating surface of the D-S rotor blade, for the benefit of early detection to prevent catastrophic damage and destruction, as suggested by Deegan (col. 1, line 19-25).

Regarding claim 24, Ding uses an improved coaxial antenna which has an extra coaxial layer (col. 6, lines 23-55).

Regarding claims 25 and 27, at least one of the measuring elements of Ding are connected to a measuring unit (col. 4, lines 39-42 and Fig. 3-4) connected to a control center (computer 10, col. 5, line 8).

Regarding claim 28, measuring, monitoring and control center inherently comprises a signaling device (electric control unit 56, col. 7, lines 45-53 and Fig. 9).

Regarding claim 31, Ding's turbine engine is a gas turbine as well (col. 7, lines 15-20).

Regarding claim 34, Ding teaches the deviation is determined by a measuring (col. 5, lines 8-15) and monitoring unit (col. 6, lines 36-7 and Fig. 3) and transmitted to a control center (computer 36, col. 5, line 14).

Regarding claims 29, 35 and 36, the teachings of D-S are reviewed above.

D-S does not include the aspect of does not include the aspect of an alarm output or engine shut down by a monitoring unit when a threshold value is exceeded.

Deegan, from the same field of specialty, teaches the shutting down of the turbine engine by the monitoring unit (Fig. 1A) when a definable threshold value is exceeded (col. 4, lines 12-14), as in claim 29. Deegan further teaches the shutting down of the turbine engine by the monitoring unit (Fig. 1A) when a definable threshold value is

exceeded (col. 4, lines 12-14), as in claim 36, and also the concept of registering an alert (col. 3, line 22), which is inherently an alarm, as in claim 35.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included Deegan's teachings of an alarm and shut down by the monitoring unit in the invention of D-S, for the benefit of preventing catastrophic failure and costly damage of the turbine engine when a threshold value is exceeded, as suggested by Deegan (col. 1, line 22).

Claims 37 - 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding, Strangman and Deegan (D-S-D), as applied to claims 21-25, 27-36 and 41 above, and further in view of IEEE Interharmonic Task Force of record.

The teachings of D-S-D are reviewed above. Deegan further teaches the use of a measurement signal processor which performs a spectrum analysis transformation with the product of this analysis passed onto a display device (col. 3, lines 19-20), as in claim 39, and compared to a definable threshold value (predetermined level, col. 4, line 14), as in claim 40.

D-S-D does not explicitly include a signal transformation by a fast Fourier transform (FFT) where it is displayed and/or signaled and compared with a definable threshold value and does not explicitly address a Fourier transformation, though it is inherent to spectrum analysis.

The IEEE Interharmonic Task Force, which refers to its work with turbine engines (p. 3, 2nd col., line 21) does include spectrum analysis (Figure 5) and the connection

between such analysis and the Fast Fourier Transformation (p. 5, 2nd col., par. 4), as in claims 37 and 38.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included FFT spectrum analysis, as taught by the IEEE Interharmonic Task Force, of the signal from a measuring element of D-S-D, for the benefit of preventing catastrophic failure by filtering a specific frequency and setting an alarm when that frequency component exceeds a predetermined threshold value, as suggested by Deegan (col. 1, line 22).

**(10) Response to Argument**

Regarding the argument that the combination of Ding and Strangman fails to teach a measuring element operating in the kilohertz range for measuring an electric field strength set up by the charge distribution of the rotor blades or guide vanes. This argument is not persuasive because, instead, the final Office Action (7/9/08) clearly indicates that Ding teaches a rotor blade measuring element for electric charge distribution (Fig. 3-5 and col. 4, line 5-15) besides explicitly operating in the kilohertz frequency range (col. 2, line 26). Furthermore, rather than having "virtually nothing to do with the problem being solved", Ding explicitly teaches a charge amplifier (8, col. 3, line 60) which is connected to a "charge-to-voltage conversion" (col. 3, line 58) which reads on the claims 21 and 41 that are being argued to claim the measuring of an electric field of magnetic field strength set up by a charge distribution. As noted in the Office Action (7/9/08), Ding further teaches the monitoring of the amplitude height (strength) of the

electric field (set up by a charge distribution) as claimed. Ding also measures the deviation from a threshold value for clearance control (col. 8, line 55-67), which is the same intended use as claimed. In fact, Ding further uses an insulating coating (Teflon, col. 6, line 45-55) and is addresses the wear of the insulating layer (33, col. 7, line 5), which accomplishes the same intended insulation function that coating of the blades would achieve electrically. Furthermore, since Ding measures the same broadly claimed electric field strength (Fig. 2) as in claims 21 and 41 for the purpose of determining a change in rotor blade clearance, which meets the broadly claimed "deviation from a threshold" of a broadly claimed “a signal”, the argument concerning an interpretation of the change in clearance as "wear" or "defect" seems superfluous, when the exact functional relationship for wear between the elements (gap vs. efficiency) is found in the prior art of Ding (s/h, %, Fig. 1a) .

Regarding the argument that Ding measures the relationship between gap and capacitance which has “nothing to do” with charge distribution, the appellant actually admits that a “capacitive measuring element” can also be provided as a coax antenna (instant disclosure, par. 46). Furthermore, with Ding’s “charge-to-voltage” conversion by the charge amplifier (col. 3, line 55-65) as “indicated in FIG. 2” (col. 4, line 64-68), it is implied that Ding also measures electric field strength, since the electric field is defined as voltage divided by gap distance (E = V/d) to one of ordinary skill in the art to which this invention pertains.

The further argument regarding the measurement of capacitance in the Ding reference as fundamentally changed from ion current measurement is also not

persuasive since the electrical circuit design of a charge amplifier and an ion current amplifier are very similar since both involve measurement of electric field strength, to one of ordinary skill in the art. However, neither one type of measurement is specifically claimed over the other by the appellant. It has been noted above that Ding converts charge to voltage. Similarly, Deegan converts ion quantity to frequency, "whose frequency is a function of the ratio of charge to mass" (col. 1, line 51) thus rendering the styles of measurement of the electric field strength in the applied references to be virtually the same.

Regarding the argument that Deegan operates in the frequency range “below 100 Hz”, and therefore “opposite to Ding” and the claimed invention, this is found to be in error since, due to the number of rotor blades on the shaft, the “blade passing frequency of a few kilohertz” is the result (col. 2, line 40) of the operating frequency range of the measuring element as claimed in claims 21, 32 and 41.

Regarding the argument concerning the combination of Ding and Deegan references is “so incongruous”, it is noted that the Deegan reference is used simply to provide an explicit teaching of the level of wear on an electrically insulating surface being related to signal strength. It was further indicated to the appellant in the final Office Action (7/9/08) that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d

413, 208 USPQ 871 (CCPA 1981). In this case, the citation of Deegan provides the claimed interpretation of an electrically measured change in the level of wear on an electrically insulating surface being related to signal strength, while Strangman proves that applying an electrically insulating coating on the rotor blade surface (instead of on the casing in Ding) has already been invented in the prior art. However, it is noted that no specific arguments are presented to indicate that the Strangman reference or the IEEE Interharmonic Task Force publication differ from the appellant's claimed limitations.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Diego Gutierrez/

Supervisory Patent Examiner, Art Unit 2831

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Date of Appeal Conference: February 18, 2009

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